

# Who's There? Experience-Driven Design of Urban Interaction Using a Tangible User Interface

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## ABSTRACT

During recent years public displays relying on new types of display technologies have made their way to the city scene. In this paper, we present a concept that combines tangible interfaces with such ubiquitous urban interaction. We set out to create a tangible connection between different cities and employed an experience-driven design process towards our concept called 'Who's There?'. We evaluated the concept by using a cardboard prototype with a group of fifteen users in a busy market square, where it generated considerable engagement and discussion with members of the public.

## Categories and Subject Descriptors

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous

## General Terms

Design, Experimentation, Human Factors.

## Keywords

Experience-driven design, Tangible user interfaces, Public displays, Connected cities.

## 1. INTRODUCTION

During recent years public displays have become ubiquitous in the wild, especially in the city scene. New types of display technologies have, e.g., enabled displays to spread into different urban facades [1]. The use of interactive public displays in urban surroundings has been studied over a long period of time [2]. These studies have revealed that users are likely to interact with public displays in groups. However, Ojala et al. [2] suggest finding means to motivate users to interact with the display. This was the main motivation for our study: to design an attractive ubiquitous user-interface connecting people between different cities. We decided to combine interactive public screens and tangible user interfaces (TUIs) into a new way of physically interacting with people in distant cities. We investigated how this combination attracts users to interact with the interface. TUIs have become the next wave of making information processing more concrete for the user, following in the footsteps of graphical user interfaces. With TUIs, the user interacts with digital information through physical objects. The metaDESK system allowed the user to interact with digital information through graspable physical

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objects [3]. Terrenghi et al. introduced a Learning Cube, which is a TUI for learning [4]. In their study, children considered the tangible appliance as a toy rather than a learning instrument. This, in turn, motivated them to learn. In our 'Who's There?' concept (Figure 1), multiple ropes act as the tangible physical part of the user interface.

The idea is that people in different cities can interact with each other by pulling ropes coming out from a display positioned on a world map. When a user in city X pulls the rope belonging to city Y, the user in city Y is able to witness how the rope belonging to city X is drawing back into the map. A similar interaction paradigm was used for the user interface in the Canopy Climb rope interface [5]. This concept physically coupled a rope to a scroll mouse. By pulling ropes, users could move a projected interface. Here, we describe our concept as well as the experience-driven design process leading to it.

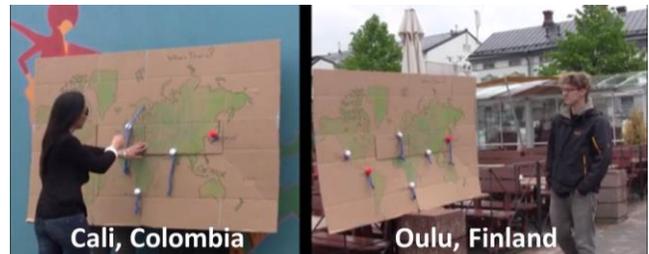


Figure 1. Prototype for urban interaction between cities.

## 2. URBAN INTERACTION DESIGN

The design process consisted of four different steps: 1) Exploring the context; 2) Using PLEX cards [6] with different brainstorming methods; 3) Constructing the cardboard prototype; and 4) Production of the video prototype (cf. Figure 1). Exploring the context consisted of field observations and interviews. We explored the public market square in a Finnish city during the summer holiday season and interviewed people. The passers-by were asked the following questions: (i) How often do you come here and why? (ii) How do you feel about using technology? (iii) What do you think about being connected to other cities whilst you are here (e.g. for the purpose of sports, communication, arts)?

After gathering qualitative information about the context and possible users, we selected three PLEX cards (see Figure 2) (fellowship, submission and competition) and used a number of formal brainstorming methods for creating the concept idea: Six thinking hats, playful scenario construction, random words, and picture collage. We came up with the idea of a 'tug-of-war' between cities. However, to avoid the potentially negative energy of competing and losing, we decided to modify the idea towards distributed interaction with a rope pulling metaphor.



**Figure 2. Selected PLEX Cards informing the design process: Fellowship, submission, competition**

### 3. EVALUATION

For communicating and evaluating our design solution we created two output artifacts: first a low-fidelity cardboard prototype and then a video prototype. With our cardboard prototype we conducted a Wizard-of-Oz user study in a busy market square (Figure 3). We asked 15 people (i) What do you think the prototype does? (ii) How do you think it works? (iii) Does it make you feel connected to another city? (iv) What could be improved?



**Figure 3. User study set up at market square**

One part of the feedback addressed the need for more connection between cities than just the tactile feeling: *a possibility to set up a textual or video chat with another user or seeing pictures of the other city*. Since the interaction can also be asynchronous, a recording of another user pulling the rope could be shown. *Sounds* were also asked for. Some people criticized the concept for being *boring and wasting electricity and nature's resources* and unnecessarily *adding technology* to the world already full of it. On the other hand, other passers-by said that it made them *feel connected* and it made *the world feel smaller*. Four users said that they *would definitely use the solution* while the other users were more hesitant. One person even said *I wouldn't use it, because it's a bit artificial*. Based on the feedback, we decided to include subtle and unobtrusive sound, yet noticeable, to generate attention when the remote TUI is used. We were concerned that pictures and textual or video chat would distract the user from pulling a rope. As a consequence, adding multimedia might result in a weaker design solution, losing the power and coherence of physicality and tangibility. Because of that we decided to omit pictures or chatting. Based on these design decisions, we produced a video prototype of the user-experience to demonstrate one possible use-case across two cities<sup>1</sup>. The video was made to act as an output artifact that can be used for further communicating and developing of the idea [7].

<sup>1</sup> <http://youtu.be/RzW9PJEpIhw> last accessed on Nov 06 2013

### 4. DISCUSSION AND FUTURE WORK

We have described the development of a lo-fi tangible interface for connecting cities across the globe. The prototype realizes a key design decision to focus purely on haptic feedback from the to-and-fro of the (digitally) connected physical ropes to provide a coherent user-experience. This notion of a single-purpose installation, with strong focus on user-experience, follows the appliance idea and contrasts with multi-purpose devices such as smartphones. We speculate that collaborative installations in public-spaces have specific demands placed upon them related to simplicity, ease of use and comprehension. We propose a single-purpose installation employing realistic physical feedback and an easily comprehensible visual design incorporating a map of the world. The production of the video, along with the development of the lo-fi prototype, provided a concrete 'physical' goal for the team that supported the group members in orientating themselves toward the project. In this way, they became boundary objects [8] that support communication across team members who have different disciplinary backgrounds and come from different work cultures. The video prototype has shown to be effective in communicating our ideas in a vivid form for connecting cities using tangible interaction. It has provoked follow-up exploratory work in designing and implementation of the communications middleware and subsequent ideas of developing engineered prototypes. We are considering making an experimental installation in a public space between multiple cities. Furthermore, an open source hardware kit could enable a single person or e.g., an office to join the network.

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